

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

DEEP TILLAGE

(acre)
Code 324



DEFINITION

Performing tillage operations below the normal tillage depth to modify the physical or chemical properties of a soil.

PURPOSE

The purpose of this practice is to:

- Fracture restrictive soil layers.
- Bury or mix soil deposits from wind or water erosion or flood overwash.
- Reduce concentration of soil contaminants, which inhibit plant growth.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to land having adverse soil conditions which inhibit plant growth, such as compacted layers formed by field operations, restrictive layers such as claypans, overwash or deposits from wind and water erosion or flooding or contaminants in the root zone. On suitable soils, deep tillage is applicable if the

restrictive soil layers are 16 or more inches deep.

This standard includes tillage operations commonly referred to as deep plowing, subsoiling, ripping, or row-till, performed from time to time below the normal tillage depth.

CRITERIA

General Criteria Applicable To All Purposes

This practice has the potential to convert (by draining) or degrade wetlands. Therefore, impacts to existing wetland functions shall be assessed. USDA Food Security Act Wetland Conservation Provisions apply. This practice must comply with NRCS wetland technical assistance policy contained in the General Manual, Title 190, Part 410.26.

Impacts to cultural resources and Federal and State protected species shall be evaluated during planning, design and implementation of this conservation practice in accord with established National and Florida NRCS policy (General Manual, Title 420-Part 401 and Title 190-Part 410.22; National Planning Procedures Handbook, FL Supplements to Parts 600.1 and 600.5).

Additional Criteria to Fracture Restrictive Soil Layers

Tillage equipment such as chisels, subsoilers, bent-leg subsoilers, or rippers, with the ability to reach the required depth shall be used.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

The depth of tillage shall be a minimum of one inch deeper than the depth of the restrictive layer. Tillage depth should be set carefully and periodically checked to maintain this working depth.

Complete fracturing of the restrictive layer is not required. The fractured zone, as a minimum, shall be sufficient to permit root penetration below the restrictive soil layer. The fractured zone does not need to extend to the row middles and should be limited to the area near the rows [in the case of crops broadcast planted or drilled in narrow rows (less than 15 inches), the fractured zone may be disrupted completely].

Deep tillage maybe performed as part of the regular land preparations and/or planting operations, except on land that is to be planted in trees or shrubs.

On all areas with restrictive soil layers that will be planted in trees and shrubs, the deep tillage will be performed approximately 3 to 4 months prior to planting to allow time for rainfall to settle the soil and fill air pockets. The seedlings will be planted within the deep tilled area.

Additional Criteria to Bury or Mix Soil Deposits from Wind and Water Erosion or Flood Overwash

Tillage equipment such as moldboard plows, disk plows, or chisels with twisted points, with the ability to reach the required depth shall be used.

The tillage operation shall uniformly mix soil 6" or twice (2 X) the depth of overwash, whichever is deeper, to achieve a desired available water-holding capacity (AWC) and to break the hydrologic barrier caused by the overwash layer.

Additional Criteria to Reduce Concentration of Soil Contaminants Which Inhibit Plant Growth

Tillage equipment such as moldboard plows, disk plows, or chisels with twisted points, with the ability to reach the required depth shall be used.

The tillage operation shall mix a sufficient amount of uncontaminated soil with the contaminated material so that the

concentration of the contaminant is below the crop tolerance level.

The soil contaminant shall be uniformly distributed throughout the deep tilled layer.

CONSIDERATIONS

Where restrictive layers are a concern, the effects of this practice can be enhanced by including deep rooted crops in the rotation that are able to extend to and penetrate the restrictive layer.

Research on numerous crops has shown that tillage conducted excessively deeper than the compacted layer does not promote increased yields, requires excessive amounts of tillage energy and promotes future compaction from nearby vehicle traffic.

Reduce or control equipment traffic during periods when soils are prone to compaction and formation of tillage pans.

When infertile flood overwash is mixed with the pre-flood soil profile, the soil rebuilding process can be enhanced by additions of organic matter, such as manure or cover crops utilized as green manure. See Florida NRCS conservation practice standard, Cover Crop, Code 340, for further guidance. Crop rotations, tillage and planting systems, which maintain high levels of crop residues, such as no-till, can also accelerate this process. See Florida NRCS conservation practice standards, Conservation Crop Rotation, Code 328 and Residue Management Practices, Codes 329A, B, C and 344 for further guidance.

Where the flood overwash layer is too thick to effectively mix with the pre-flood soil profile, redistribution of the overwash layer by smoothing or removal may be necessary. Generally, no more than about 6 inches of overwash can be uniformly mixed into the soil profile using commonly available equipment. Specialized equipment may be necessary where greater depths of overwash are to be incorporated.

Where unfavorable soil materials such as high sodium, calcium, gypsum or other undesirable materials, are within anticipated deep tillage depth and would be brought to the surface by deep tillage operations, this practice should not be applied.

Transport of sediment-borne pollutant(s) offsite can be reduced when this practice is used in a conservation management system, by reducing the concentration of pollutants in the surface layer.

To help reduce compaction, it is desirable to conduct normal tillage operations when soil moisture is less than 50 percent of field capacity. When possible harvest operations should be avoided when soil moisture is greater than 50 percent of field capacity. Field harvest haul traffic should be limited to end rows or haul roads. Compacted regions between crop rows that are not fractured can assist in supporting vehicle traffic, limiting rutting and soil compaction beneath the row.

Generally, the higher the soil organic matter content, the less soil compaction.

Approximately 30 horsepower per subsoil shank is required in Southern Coastal Plain and Atlantic Coast Flatwoods soils. Heavily eroded soils, critical areas, and soils with higher clay content may require more horsepower. Bent-leg subsoilers require even more horsepower.

PLANS AND SPECIFICATIONS

Specifications for establishment and operation of this practice shall be prepared for each field or treatment unit according to the Criteria, Considerations and Operations & Maintenance described in this standard. As a minimum the specifications shall include:

1. Field evaluations will be made to determine the need and feasibility for deep tillage.
2. Implements used must penetrate through and shatter the restrictive layer. Use a ripper and chisel-type plow so that the subsoil will not be brought to the surface.
3. Space implements so that the soil will be loosened from one furrow to another. This can best be determined by the type and condition of the soil.
4. Deep tillage should be performed on or near the contour on all sloping soils.
5. Deep tillage operations shall be performed when the soil moisture is less than 25 percent of field capacity according to the "feel and appearance method" or other acceptable method, at the maximum depth to which the tillage will be performed.

OPERATION AND MAINTENANCE

Deep tillage for reduction of soil compaction shall be performed whenever compaction reoccurs.

When deep tillage has been performed to reduce the concentration of soil contaminants, the contaminant levels in the root zone shall be monitored to determine when or if treatment will be reapplied.

REFERENCES

NRCS Conservation Practice Standards
Conservation Crop Rotation (Code 328)
Residue Management (Codes 329 A, B, C and Code 344)
Cover Crop (Code 340)

General Manual – Title 190 and 420

National Planning Procedures Handbook –
FL Supplements

USDA – Food Security Act